AGRICULTURAL WATER QUALITY ISSUES FOR DELTA SOURCE WATER

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STATUS OF THE DELTA AS A RESOURCE FOR AGRICULTURAL WATER PURPOSES

DELTA AGRICULTURE AND WATER QUALITY*

Briefing Paper
for Bay-Delta Oversight Council
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Background

The Delta covers an area of more than 738,000 acres, about 75 percent (520,000 acres) of which is used for agriculture. Approximately 445,000 acres are irrigated and 75,000 are dryland farmed. Delta agriculture produces almost $500 million annually in various crops, about 3 percent of gross agricultural receipts statewide. Figure 1 shows the variety of crops grown in the Delta with the predominant crops being corn, grains, tomatoes, and alfalfa.

Recently the State Legislature passed two bills with respect to Delta agriculture. SB 1866, The Delta Protection Act of 1992, establishes the Delta Protection Commission which will develop a long-term resource management plan for the Delta. This plan will protect agricultural land in the Delta from the intrusion of nonagricultural uses. The second bill, SB 443, The Delta Land Use Survey Act, requires the Department of Water Resources to prepare a Delta land use report by 1994. The Department has initiated work on a new land survey and a subsequent land use report.

Soils in the Delta fall generally into two categories, organic and mineral. Organic soils constitute 68 percent of the total cropped

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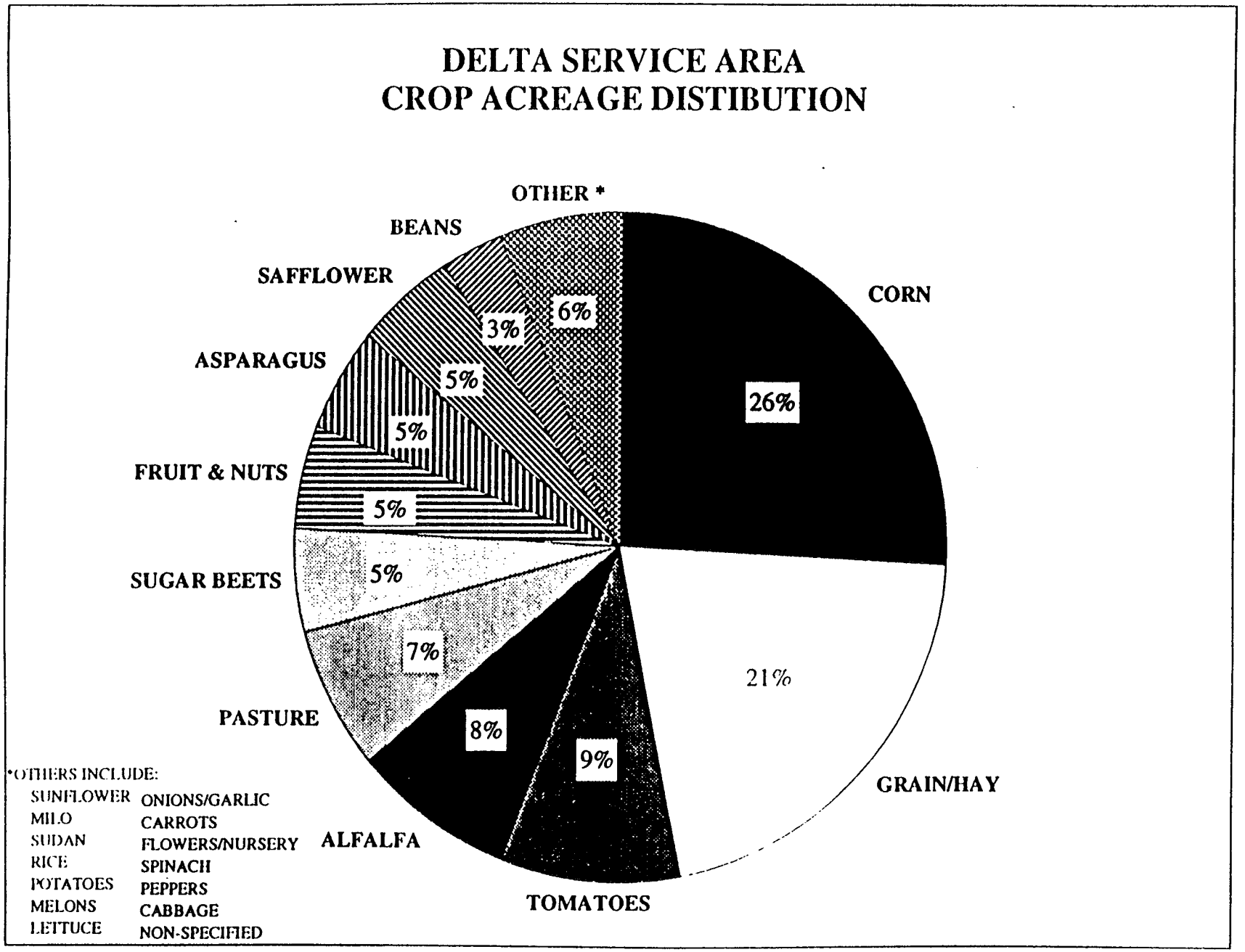
Figure 1



Source: Bay-Delta Hearings Exhibit DWR 308

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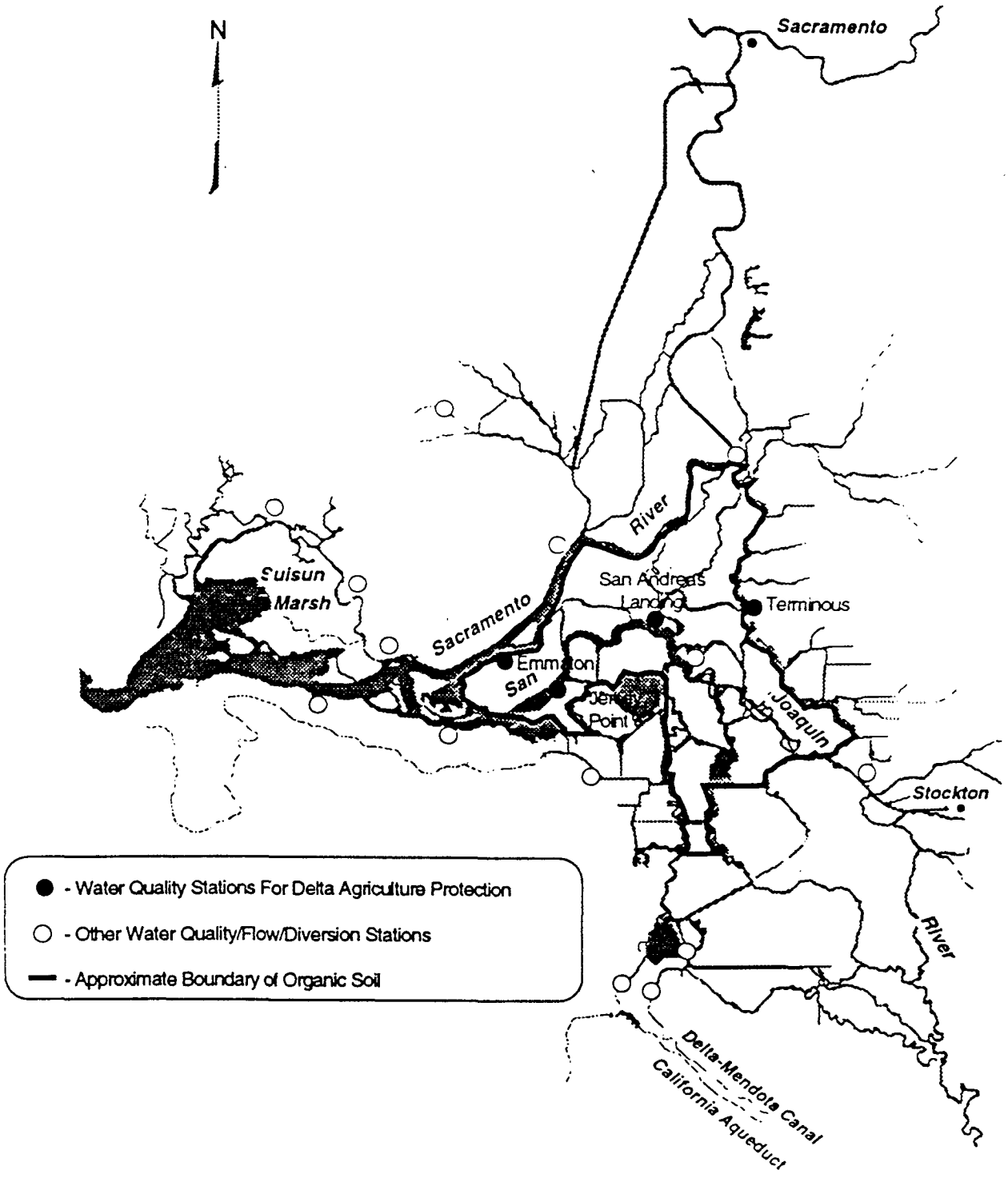
Figure 2

San Francisco Bay-Delta Estuary
Locations where Decision 1485 Standards apply



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area and mineral soils the remaining 32 percent. Organic soils are usually found in the Delta Lowlands below an elevation of -5 feet mean sea level (Figure 2). The amount of organic soil in the Delta is constantly being reduced due to continuous decomposition and oxidation from natural causes and farm practices.

Management strategies and cropping patterns in the Delta are different depending on the soil type. Predominant crops grown on organic soils are corn, grains, and tomatoes. Subirrigation[1] is the predominant method of irrigation on organic soils. Subirrigation is used mainly because organic soils tend to have uneven surfaces, due to subsidence, and are highly permeable making water movement across the surface very difficult. Subirrigation is usually combined with a winter leaching program to remove salts from the root zone. In mineral soils, subirrigation is generally not necessary and more conventional irrigation methods such as furrows and sprinklers are used.

Salinity is the most critical water quality factor for Delta agriculture. The salinity of the applied water has a direct relationship to the quality of the water in the soil solution, which in turn affects crop yields. A balance between the salts which enter the root zone via the applied water and those which leave through drainage water must be maintained. If salts accumulate, the excess salts must be leached or flushed out of the

[1] Subirrigation is the practice of applying water beneath the soil surface rather than on top. Water is siphoned from a channel into a main "surface" ditch. The surface ditch distributes the water to shallow "spud" ditches which run laterally through the field. Water in the spud ditch moves laterally and downward to raise the water table and irrigate the crop from below.

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root zone to achieve this salt balance. The normal management practice for crops grown on organic soils includes winter leaching[2] every one to three years depending on the crop grown and the quality of the water used for irrigation. The University of California Cooperative Extension has developed guidelines[3] for determining the crop yields expected with a given applied water salinity. Electrical conductivity is used as the most practical indicator of the salinity level of Delta waters.

Sources of Salt Load In Delta Channels

Water quality conditions in the Delta are highly variable depending primarily on freshwater inflow rate, local and upstream agricultural drainage, and the strength of ocean tides which are affected by weather fluctuations. Delta waters are a mixture of seawater and freshwater including return flows of various salinity levels. Salt enters the Delta from two main sources: seawater and agriculture drainage. Salt from seawater enters the Delta through tidal action. The tides represent the combined effect of the earth's motion and the gravitational influence of the sun and moon. The tides go through one complete cycle approximately every 25 hours. Each tidal cycle includes two high tides and two low tides. The back-and-forth motion of the tide provides the main flushing action in the Delta, except during periods of very high Delta outflow. Twice daily, tidal flows of magnitude greater than

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[2] Leaching is the practice of flushing salts from the root zone area of the soil, and is used to control salt accumulation in the soil.

[3] D-1485 Hearings Exhibits UC 1,2

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300,000 cfs are transported back-and-forth in the western portion of the Delta. In addition to the daily tidal cycle, each month the tide completes two 14-day spring-neap cycles with greater tidal fluctuations (spring tides) followed by tides with lower fluctuations (neap tides). During certain tides, a net upstream transport of higher salinity water is induced.

To repel ocean salinity, the Delta must be supplied with a continuous inflow of fresh water from the Central Valley. During periods of high runoff following storm events, the excess water is sufficient to repel salinity as well as meet export needs. When there is little runoff, water stored in upstream reservoirs must be released to keep seawater from intruding into the Delta, thereby, maintaining the salt balance. Before the major reservoirs were constructed, the Delta was vulnerable to severe salinity intrusion during prolonged droughts. In 1931, for example, ocean salts (1,000 ppm chlorides) intruded as far upstream as Courtland on the Sacramento River.

Salt intrusion is caused by the tidal flows (and resulting dispersion) transporting salt into the interior portion of the Delta. When freshwater flows through the Delta are low and export pumping is high, the net flow in the lower San Joaquin River can become quite low or even reversed. To avoid exacerbating salinity intrusion during such times, the SWP and CVP must make additional reservoir releases (known as "carriage water") to continue pumping operations while maintaining suitable water quality throughout the Delta.

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The second source of salt is agricultural drainage. When irrigation or leaching operations drain water from the fields salts are flushed out into the channels. Also, the first rainfall of the season can flush salts which have accumulated in the soil causing some localized problems in the receiving water.

SWRCB Decision 1485 Standards

Through D-1485, adopted in 1978, the State Water Resource Control Board established water quality standards to protect Delta agriculture for three geographic areas: the western, interior, and southern Delta. Western and interior portions of the Delta consist mainly of organic soils, while mineral soils dominate the southern Delta. The particular needs of each area were determined by predominant crops, soil type, and irrigation practices. The standards were designed to replicate conditions in the Delta before the CVP and SWP came on-line--the so-called "without project" standards.

In the western and interior portions of the Delta corn is the predominant salt-sensitive crop, and is grown on subirrigated organic soils. The SWRCB determined that the maximum salinity of applied water necessary to maintain a 100 percent corn yield was 0.45 EC. This standard provided water quality for that portion of the irrigation season that would have occurred in the absence of the projects. The standards for the remaining portion of the irrigation season reflected a salinity which when weighted with the 0.45 EC would be equivalent to the without project weighted average over the entire irrigation season (April 1 - August 15).

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For southern Delta agriculture the SWRCB decided that construction of physical facilities was the most practical solution for long-term protection, and since negotiations between DWR, USBR, and SDWA concerning these facilities were underway, no standards for the South Delta were adopted in D-1485.

Standard-Setting Activity Since 1978

In 1987, the SWRCB revisited D-1485 in the Bay-Delta Proceedings pursuant to a 1986 court order. In partial fulfillment of the mandates of this court order, SWRCB in the spring of 1991 released the *Water Quality Control Plan for Salinity* (WQCP).

During the time period between D-1485 and the Proceedings more information concerning the protection of western and interior Delta agriculture was gathered. From 1979 to 1984 DWR and SWRCB cosponsored a 4-year field study ("Corn Study") conducted by the University of California Cooperative Extension and the U.S. Department of Agriculture. The purpose of the study was to establish the salt tolerance of corn grown in the Delta, and to determine the relationship between Delta surface water salinity and soil salinity, and how this relationship is influenced by soil properties, rainfall, and management practices. The study found that a 100 percent corn yield on subirrigated soils could be achieved by using irrigation water of up to 1.5 EC. The general conclusion of the study was that corn could be grown and maintained using saltier water than that prescribed in D-1485 as long as controlled leaching was performed periodically to

effectively remove accumulated salts. The Corn Study did not provide information as to effectiveness or economics of current Delta leaching practices. The SWRCB decided that more information regarding the practicality of leaching operations was needed, and therefore, the D-1485 standards were continued.

A Delta Agriculture workgroup was subsequently formed, and a study was initiated to determine the feasibility and effectiveness of leaching practices currently used in the Delta. Results from this study are expected this year.

For the southern Delta, the SWRCB developed standards to protect two predominant salt-sensitive crops, beans and alfalfa. In developing these standards, the SWRCB used information from the evidentiary hearings, the Delta Agriculture Workgroup, and the South Delta negotiations among DWR, USBR, and SDWA. The SWRCB based their objectives on U.C. guidelines and the SWRCB's 1978 Delta Plan. The guidelines recommended an applied water quality of 0.7 EC during the irrigation season. For the remainder of the year, the water quality standards were based on the 1978 Delta Plan which recommended a water quality of 1.0 EC to protect the needs of those crops grown year-round. Also, the 1991 WQCP proposed a staged implementation of the south Delta standards, with final implementation to take place by 1996.

The 1991 WQCP also included a provision for revising the southern Delta standards pending an agreement between DWR, USBR, and SDWA. In September 1991, an agreement, which provides for the construction of barrier facilities in various south Delta channels

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to afford SDWA an adequate agricultural water supply in terms of quantity, quality, and channel water levels, was drafted. DWR and SDWA are ready to sign the agreement and are awaiting Congressional approval.

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